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Sustainability in an IT Context

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Sustainability

in an IT context

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Information Services & Technology

WCU
WEST CHESTER UNIVERSITY
IS&T

ABOUT IS&T

- WCU's Central IT Division
- On the Web at https://www.wcupa.edu/IST/
- Faculty and Staff Help Desk located in Anderson Hall. Student Help Desk located in Brandywine Hall
- Division Offices in **Anderson**, **Allegheny**, **Brandywine**, and **Wayne Hall**, and the **DAC** (Matlack, next to IR and Post Office)

MISSION AND VALUES

https://www.wcupa.edu/infoServices/missionValues.aspx

Mission

WCU IS&T supports student success through strategic information technology and partnership with the entire university community.

Values

COLLABORATION

we work together collegially and effectively, within the Division and across the University

INNOVATION

we identify and implement solutions to address challenges, being open to and seeking new ideas and creative approaches

SERVICE ORIENTATION

we recognize and even anticipate the needs of our University colleagues, and seek to be of help and good service

STEWARDSHIP

we are responsible and professional in our management of IT resources of all types, as well as for associated budgets

INTEGRITY

we strive for honesty and transparency in all we do

AGENDA IN 3 PARTS

01

The concept of Green IT

02

Other senses of the word "Sustainability" for IT

03

Questions and Open Discussion

PART 1: GREEN IT

The term ***sustainability*** is often used specifically in terms of ***environmental sustainability***

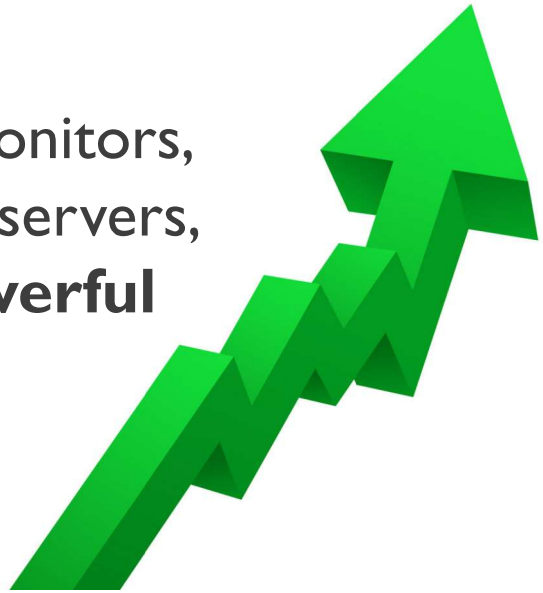
"*Green IT*" or "*Green* Computing" refers to energy-saving and waste-reducing practices within the Information Technology field.

Let's start by thinking about 2 competing trends that can affect the ability to pursue *Green IT*

THINKING ABOUT GREEN IT: TREND 1

Trend 1: Efficiency of IT Equipment Rises

- IT equipment such as personal computers and monitors, printers, and also data center equipment such as servers, mass storage, routers, firewalls, all get **more powerful and more power-efficient over time**.

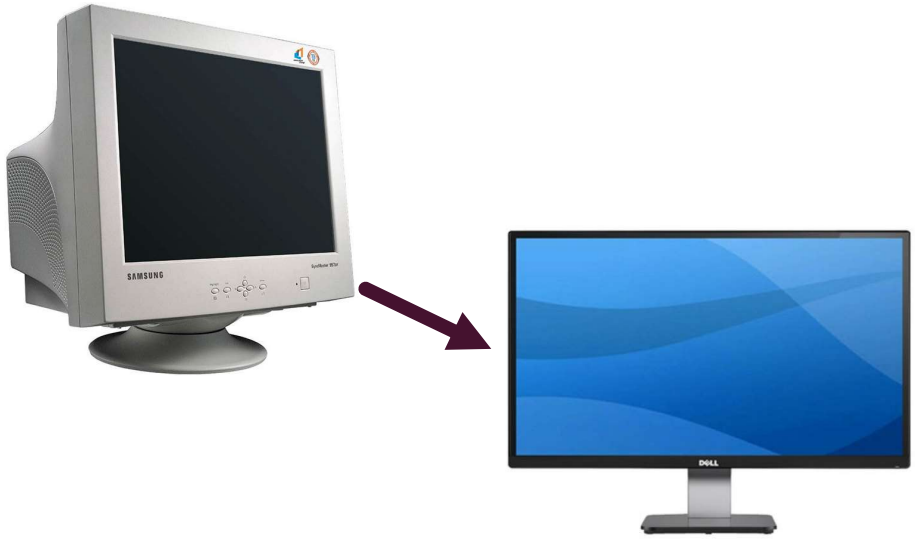


THINKING ABOUT GREEN IT: TREND 1

Trend 1 Examples: Monitors

- Energystar.gov tells us that the energy-consumption of an LCD display can be half to two-thirds of that for an average CRT - and efficiency continues to rise.

- In addition to the obvious energy and cost savings, reduced monitor heat generation can contribute to lower cooling costs.



THINKING ABOUT GREEN IT: TREND 1

Trend 1 Examples: Computing Power

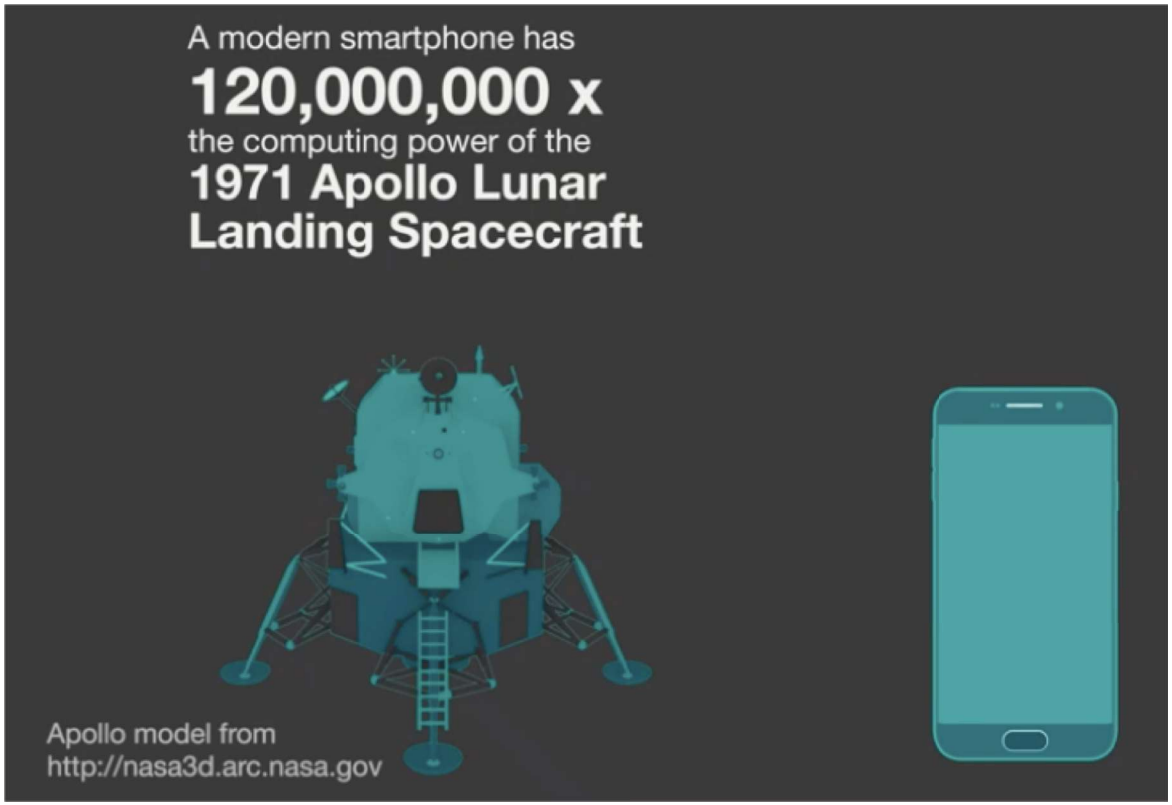
- Single computers took up large server rooms just a few decades ago. They were slow, problem-prone, and required a great deal of power and cooling.

- Today, dense blade-servers fill racks in data centers. They are scalable, more reliable, orders of magnitude faster, and they use much less power.

THINKING ABOUT GREEN IT: TREND 1

Trend 1 Examples: Smartphones

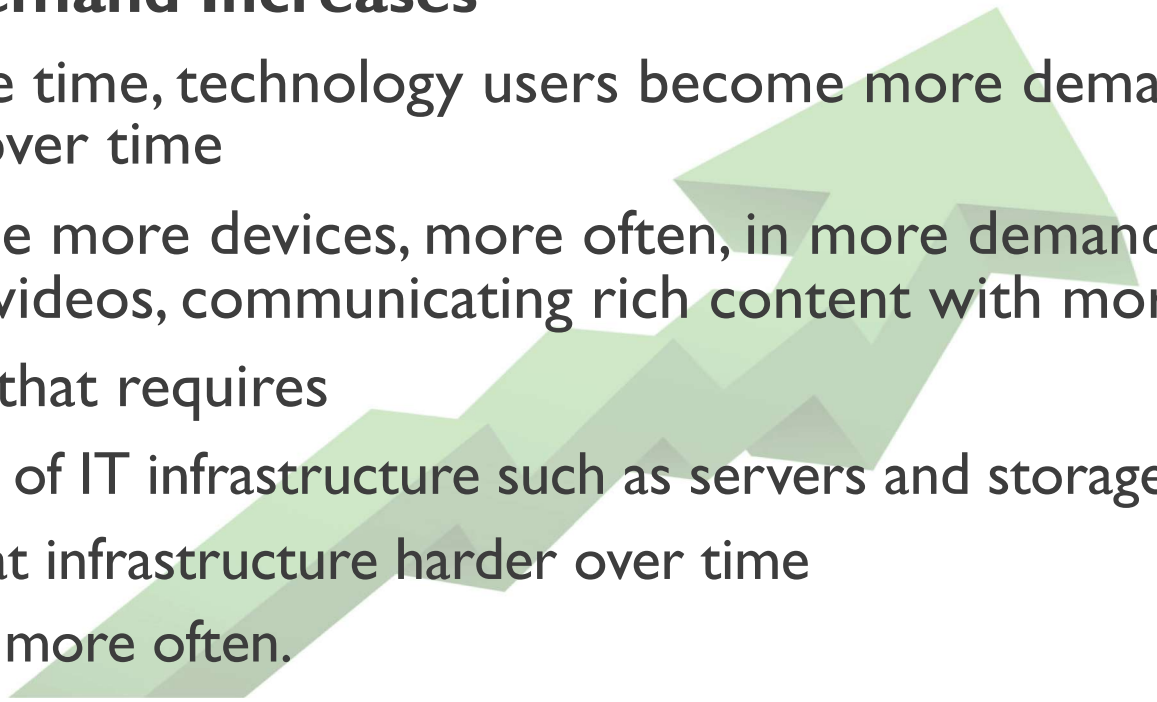
- more powerful than computers used on Apollo missions



THINKING ABOUT GREEN IT: TREND 2

Trend 2: Demand Increases

- At the same time, technology users become more demanding of IT resources over time
- We each use more devices, more often, in more demanding ways (streaming videos, communicating rich content with more people, etc.)
- Over time, that requires
  - expansion of IT infrastructure such as servers and storage
  - driving that infrastructure harder over time
  - upgrading more often.



THINKING ABOUT GREEN IT: COMPETING TRENDS

Trend 1 and Trend 2 Compete!

- IT equipment and practices get more efficient
- Demand for IT services sky-rockets

THINKING ABOUT GREEN IT: TREND 2

Trend 2: Impact on data centers

- As demand rises, IT data centers become more crowded with more servers and storage, draw more power, and have a greater heat load to dissipate
- IT responds with more efficient practices
- Let's look at some examples at WCU

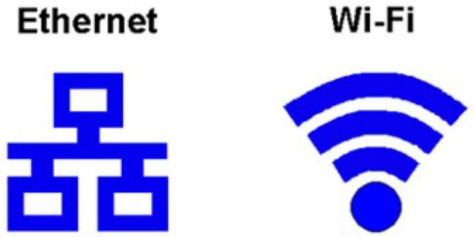
GREEN DATA CENTER PRACTICES

- **Lights Out Operations** – today's data centers are unmanned, and literally operate with the *lights out*.
- **Cold aisle containment** -The top of the rack is typically affected by hot exhaust air recirculation. *Cold aisle containment* systems are designed to eliminate these hot spots, allowing data center cooling to operate more efficiently.

- **Blade Servers** - A *blade server* is a stripped-down server computer with modular design optimized to save space and minimize power consumption
- **Virtual Servers** - A *virtual server* is a server that shares hardware and software resources with other operating systems (OS), versus dedicated servers.

GREEN IT BEYOND THE DATA CENTER

WiFi versus Wired Ethernet



- Emphasizing wireless network access allows us to reduce copper cabling needed and the number of network switches required.
- This in turn reduces the amount of electricity and air conditioning for those network switches in the building's network closets, which helps to reduce our carbon footprint

GREEN IT BEYOND THE DATA CENTER

Power Utilization of End User Devices

- In WCU student computer labs, we set the computers/monitors to go into sleep mode after 30 minutes of inactivity; and the printers enter sleep mode after 15 minutes of inactivity;
- Digital signage monitors are remotely scheduled via a script to power off at certain times depending on building schedule
- The campus AV systems automatically power off daily at midnight; and we are now deploying lampless, laser projectors so no need to replace/recycle projector bulbs

GREEN IT BEYOND THE DATA CENTER

Re-use and Recycling

- WCU IS&T works with a local recycling company that focuses on security (hard drive data destruction) and sustainability by refurbishing or recycling computers, printers, batteries, and other technology equipment
- All residual "e-waste" and obsolete hardware is properly disposed of domestically in an R2, ISO 9001, ISO 14001 facility.
- The funds we are reimbursed for recycled equipment are then allocated to the tech operations budget that help to support the technical operations of deploying new end-user equipment, technician tools, department vehicle service maintenance, etc.

GREEN IT BEYOND THE DATA CENTER

Re-use and Recycling

West Chester University Technology Recycling Program - FY17

Month	Total Weight	# Repurposed	# Recycled
7/29/2016	3076	128	65
Aug-16	5933	232	146
10/21/2016	4788	60	54
1/20/2017	3983	108	84
3/17/2017	3446	84	54
6/1/2017	2750	92	47
6/30/2017	3717	55	48
Total	**27693**	**759**	**498**

GREEN IT BEYOND THE DATA CENTER

Reduction of paper waste, some WCU examples

- RamPrint systems cut down on wasted printed pages as double sided is the default, and print jobs get purged if the student doesn't log in to release the job
- Electronic delivery of materials through technologies such as D2L, RamCast and eTextbooks reduce the amount of printed pages
- The Faculty Tenure and Promotion review process was a paper-intensive process until IS&T partnered with Academic Affairs on a fully online process
- Council of Trustees meetings were a paper-intensive process until IS&T partnered with the Presidents Office on a fully online process using an Online Board Portal to replace the COT Meeting Board Book

GREEN IT BEYOND THE DATA CENTER

Video Conferencing

- Video teleconferences can greatly reduce business travel impacts. One study found that a video conference requires 500 times less energy than a business trip that includes a 1,000 km (663 miles) flight.
- https://blog.zoom.us/wordpress/2013/08/22/how-video-conferencing-makes-the-world-greener/

PART 2: SUSTAINABLE IT SOLUTIONS

In the IT field, we work to achieve technology solutions that **run successfully unattended** and with minimal manual intervention.

A related concept is **resilience**. We want solutions that can continue to operate even in the presence of conditions or inputs that are outside the expected. (Bad data, bad power, high or low temps, etc.)

We call solutions that are well-behaved in these ways ***sustainable solutions***, because they are the opposite of ***unsustainable solutions***

SUSTAINABLE IT SOLUTIONS

- If someone told you that a server was boasting 95% uptime, would you be impressed?
- That level, sometimes called "1.5 nines," implies more than 18 days of downtime per year!
- The reliability of a 95% consumer solution may not be acceptable in an enterprise setting.

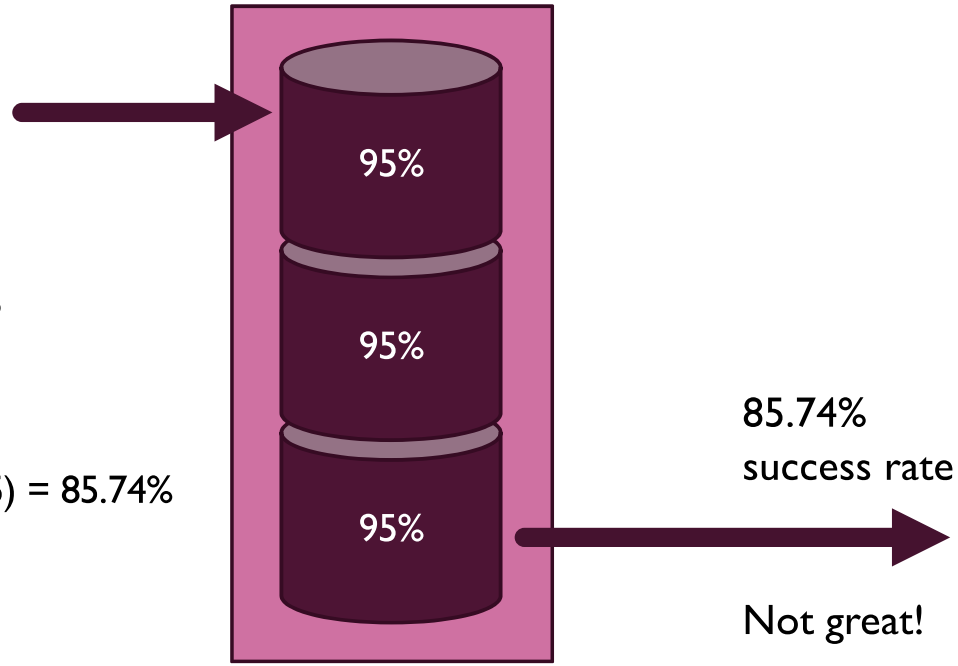
(Discussion: Why not?)

DOWNTIME AND AVAILABILITY OF SERVICES

Availability %	Downtime per year	Downtime per month	Downtime per week
90% ("one nine")	36.53 days	73.05 hours	16.80 hours
99% ("two nines")	3.65 days	7.31 hours	1.68 hours
99.5% ("two and a half nines")	1.83 days	3.65 hours	50.40 minutes
99.9% ("three nines")	8.77 hours	43.83 minutes	10.08 minutes
99.95% ("three and a half nines")	4.38 hours	21.92 minutes	5.04 minutes
99.99% ("four nines")	52.60 minutes	4.38 minutes	1.01 minutes

MAXIMIZING AVAILABILITY

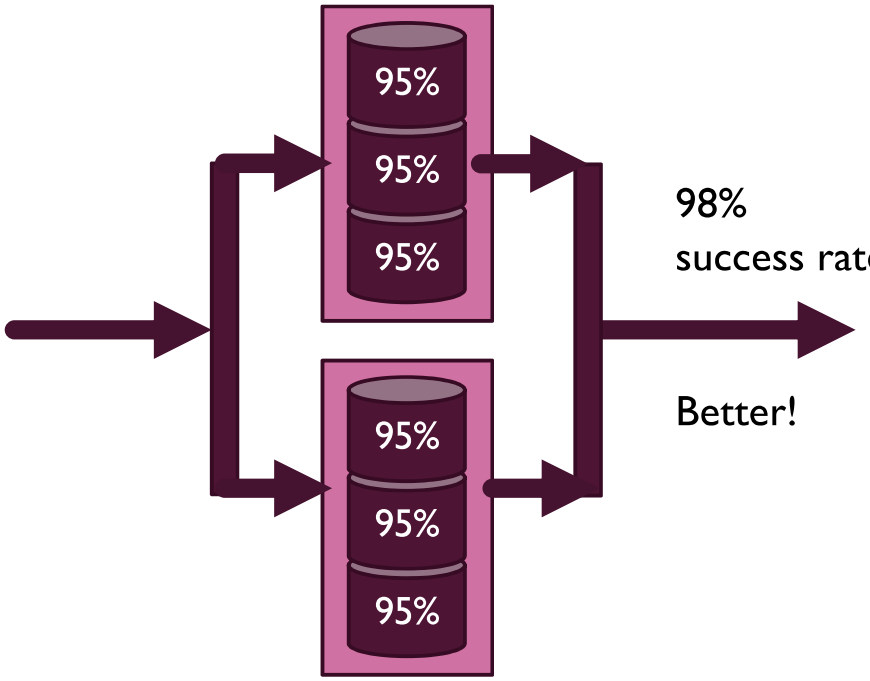
- All solutions have a failure rate
- Let's look at the math around solutions that use several parts



Reliability = (0.95*0.95*0.95) = 85.74%

MAXIMIZING AVAILABILITY

- All solutions have a failure rate
- Let's look at the math around solutions that use several parts
- While combination solutions have failure rates defined by the failure of any part, replicated solutions can significantly reduce failure rates!

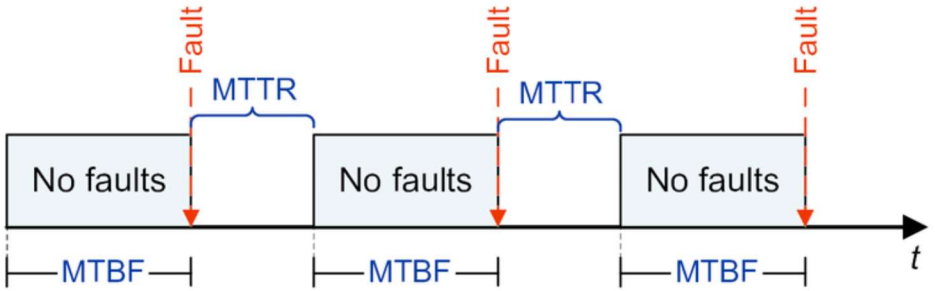


Reliability = 1 - (1 - 0.8574) * (1 - 0.8574) = 98% !

RELIABILITY ENGINEERING

Some basic terminology in Reliability Engineering

- Mean Time Between Failures (**MTBF**) is the average time from one failure to the next.
- Mean Time To Repair (**MTTR**) is the average time that it takes to repair something after a failure.
- **Availability** of a device is **MTBF / (MTBF + MTTR)**



SUSTAINABLE IT SOLUTIONS: – WHAT'S THE TAKE AWAY?

Sustainable Solutions

- Consumer solutions need only work for one or a few people, and some inefficiency and downtime might be tolerated.
- Enterprise solutions need to work for thousands of people. They need to be **reliable** and **resilient**, and to operate correctly with **minimal intervention**. This makes them **sustainable solutions**.

IN SUMMARY

- Technology has a tendency to improve rapidly and to get both more powerful and more energy efficient.
- Users have a tendency to demand more of technology over time.
- IT Professionals work toward Green IT by trying to overcome the demand growth with environmentally sustainable practices.
- In another sense of the word sustainability, we prefer solutions that are well-behaved and that **run successfully** with minimal manual intervention – These are ***sustainable solutions.*** This concept is related to efficiency and financial sustainability but with some unique IT properties.

Sustainability

in an IT context

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QUESTIONS AND DISCUSSION

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